

Competency III:

Treatment, Intervention, and Referrals

III-1. Treatment: Be able to effectively treat health conditions related to pesticide over-exposures.

Content (Medicine)

- Know that supportive therapy is often the mainstay in treating the pesticide-poisoned patient.
- Understand the general principles of airway control in managing a pesticide-poisoned patient:
 - ▶ *Be able to intubate the patient and provide emergency ventilation (residents, selected advance practice nurses)
 - ▶ *Understand pesticide-specific instances with regard to O₂:
 - ▶ Organophosphates/Carbamates: adequate oxygenation is essential prior to administering atropine.
 - ▶ Diquat / Paraquat: Oxygen is contraindicated in the early stages due to progressive oxygen toxicity to lung tissue.
- Understand principles of gastrointestinal decontamination:
 - ▶ Know the uses, indications, and contraindications for each of the following: syrup of ipecac, gastric lavage, catharsis, & activated charcoal.
 - ▶ Know that ipecac is no longer recommended for routine use in most poisonings.
 - ▶ *Know proper dosage of activated charcoal.
 - ▶ *Know that if a second dose of activated charcoal is needed in children, it should be without a cathartic to avoid sudden electrolyte shifts.
- Understand principles of seizure management:
 - ▶ Diazepam is used in many of the reported pesticide poisonings including organochlorines and others.
 - ▶ Lorazepam is now being recognized as the drug of choice for status epilepticus, although there are few reports of its use with certain pesticides.
 - ▶ *Know that with organochlorine poisoning, seizures can be refractory and may require several medications and possibly pentobarbital coma.
- *Be able to provide necessary cardiac life support.
- *Understand that decontamination, life support, and emergency care may need to be provided concurrently.

* An asterisk denotes material for residents and nurse practitioner students over and above that of the undergraduate.

- Know that many signs and symptoms are non-specific and many agents have no specific antidotal treatment.
- Understand special treatments required for certain pesticides:
 - ▶ Organophosphates and Carbamates
 - ▶ Know that tissue oxygenation must be improved as much as possible prior to giving atropine.
 - ▶ *Know required atropine dose and dosing intervals. Be aware that the dose for cholinesterase-inhibiting insecticides is much higher than that for cardiac resuscitation.
 - ▶ *Know the indications for pralidoxime.
 - ▶ *Know that pralidoxime is usually not needed for carbamates because the enzyme-pesticide complex rapidly dissociates; therefore atropine alone is effective.
 - ▶ Pyrethroids
 - ▶ Be able to provide supportive therapy.
 - ▶ *Know that Vitamin E oil preparations may prevent or stop paresthesias.
 - ▶ *Arsenicals
 - ▶ Know that initial chelation is performed using dimercaprol (BAL) as an intramuscular injection.
 - ▶ After gastrointestinal tract is free of arsenic, one may consider an oral chelating agent such as DMSA ("Succimer"), which is available in the U.S. but not labeled for this use.
 - ▶ *Organomercury Compounds (fungicides)
 - ▶ DMSA ("Succimer") is probably the most effective agent available in the U.S.
 - ▶ *Hydrogen Cyanide and Acrylonitrile (transformed to hydrogen cyanide)
 - ▶ Amyl nitrite by inhalation 15-30 seconds of every minute.
 - ▶ Sodium nitrite 3%; 10 mL given I.V. over 5 minutes.
 - ▶ Sodium thiosulfate 50ml of 25 % solution given I.V. over 10 minutes.
 - ▶ The above antidotes are commercially available as the Lilly Cyanide Antidote Kit.
 - ▶ *Rodenticides (specifically "superwarfarins" such as brodifacoum)
 - ▶ For ingestion larger than about 1 mouthful, prothrombin time (PT) is currently recommended at 24 to 48 hours post-ingestion.
 - ▶ More recent data suggest that if a known quantity (small amount) is unintentionally ingested, PT measurement may not be necessary.
 - ▶ Phytonadione (vitamin K1) is given for an elevated PT or signs of bleeding.
 - ▶ If taken during the preceding 15 days, determine patient's PT and give vitamin K1 intramuscularly if PT is significantly prolonged.
 - ▶ Intravenous vitamin K1 should be reserved for patients with active bleeding only, due to potential severe side effects.

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- ▶ Be aware that PT prolongation and bleeding are much more likely in cases of *intentional* ingestion, and that due to a very long half-life of superwarfarins, PT prolongation may persist for months.
- ▶ *Sodium chlorate and cyanide can result in methemoglobinemia.
 - ▶ Know that methylene blue is indicated when about 25-30% of hemoglobin has converted to methemoglobin.
 - ▶ The dose is 0.1 ml/kg body weight of 1% solution over 10 minutes.
 - ▶ Know that an exchange transfusion may enhance clearance in severe cases.
- Chronic effects: Be aware of recent research on chronic effects associated with pesticides, including the following (non-exhaustive) list:
 - ▶ Cancer
 - ▶ Leukemia and brain tumors have been noted in many epidemiological studies to be associated with pesticides.
 - ▶ Epidemiology suggests that DDT and other agents may increase risk for breast and ovarian cancer.
 - ▶ Risk factors:
 - ▶ parental occupation
 - ▶ family use of pesticides (e.g., pest strips, termite treatment, flea collars for pets)
 - ▶ Birth Defects
 - ▶ Norwegian farmers -- CNS, orofacial clefts, male genitalia, and limb reduction defects
 - ▶ Canadian families near agriculture center -- spina bifida and stillbirth
 - ▶ Minnesota -- higher rates of unspecified birth defects
 - ▶ Endocrine Disruption
 - ▶ Emerging concern for pediatricians, but controversy remains.
 - ▶ Many chemicals in environment bind to endocrine receptors; some are pesticides.
 - ▶ Organochlorines are the most well known (DDT, chlordane, heptachlor, dieldrin)
 - ▶ DDT is still highly persistent in environment
 - ▶ Endosulfan, atrazine, & 2,4-D still used in U.S.
 - ▶ Animal studies confirm in vitro activity:
 - ▶ Rat exposure to chlordane results in masculinization of female rats
 - ▶ Other agents have caused feminization of alligators.
 - ▶ Chronic Neurologic Effects Association with Organophosphates
 - ▶ Follows acute and subacute exposure
 - ▶ Headaches, blurred vision, depression, memory loss, irritability, poor concentration
 - ▶ Epidemiological studies in adults have supported these observations.
 - ▶ No controlled studies have been done in children.

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Points of Insertion

■ Nursing

- ▶ Adult Health Nursing courses (didactic and clinical). Undergraduate nursing students should be able to recognize and provide supportive care to patients with pesticide poisoning. Advanced practice nurses, especially primary care nurse practitioners and occupational health nursing practitioners, should be able to diagnose and treat patients with pesticide poisoning.
- ▶ Community Health, Public Health Nursing, or Pediatric Nursing courses (didactic and clinical)
- ▶ Environmental Health Nursing elective

■ Undergraduate Medicine

- ▶ 2nd year Pharmacology and Pathology courses
- ▶ 3rd year clinical rotations
- ▶ 4th year ER rotations, Environmental Medicine elective

■ Residents

- ▶ ICU rotations
- ▶ ER and inpatient rotations

III-2. Intervention: Be able to advise health care providers on decontamination of patients and the environment following over-exposure.

Content (Medicine, Advanced Practice Nursing, and Specialty Environmental Health Nursing)

- Advise other health care providers on how to decontaminate patients and the environment following over-exposure.
 - ▶ Understand principles of skin decontamination, flushing eyes with water.
 - ▶ Understand proper clothing and precautions for emergency personnel, including goggles and rubber gloves.
 - ▶ Be aware that pesticide contamination can occur on the insides of boots and gloves.
- Understand that site decontamination needs to occur. Examples include:
 - ▶ Environmental exposure at home or school with excess pesticide residue
 - ▶ Hospital exposure to personnel resulting in toxicity to health care providers

Points of Insertion

■ Nursing

- ▶ Advanced Adult Health Nursing courses (didactic and clinical)
- ▶ Advanced Community Health or Public Health Nursing courses
- ▶ Environmental Health Nursing elective

- Undergraduate Medicine
 - ▶ 2nd year Pharmacology and Pathology courses
 - ▶ 3rd year clinical rotations
 - ▶ 4th year ER rotations, Environmental Medicine elective

- Residents
 - ▶ ICU rotations
 - ▶ ER and inpatient rotations

Resources for Competencies III-1 and III-2

ATSDR Case Studies in Environmental Medicine, Agency for Toxic Substances and Disease Registry, www.atsdr.cdc.gov/HEC/CSEM

Helmuth RA, McCloskey DW, Doedens DJ, et al. Fatal ingestion of a brodifacoum-containing rodenticide. *Lab Med* 1989;20:25-7.

LaDou J, ed. *Occupational and Environmental Medicine*, 2nd ed. Stamford, CT: Appleton & Lange; 1997.

Lieske CN, Clark JH, Maxwell DM, et al. Studies of the amplification of carbaryl toxicity by various oximes. *Toxicology Letters* 1992;62:127-137.

Lipton RA, Klass EM. Human ingestion of a "superwarfarin" rodenticide resulting in a prolonged anticoagulant effect. *JAMA* 1984;252:3004-5.

Muckter H, Liebl B, Beichl FX, et al. Are we ready to replace dimercaprol (BAL) as an arsenic antidote? *Hum Exp Toxicol* 1997;16:460-5.

Mullins ME, Brands CL, Daya MR. Unintentional pediatric superwarfarin exposures: Do we really need a prothrombin time? *Pediatrics* 2000;105:402-4.

Reigart JR, Roberts JR. *Recognition and Management of Pesticide Poisonings*, 5th ed. Washington, DC: U.S. Environmental Protection Agency; 1999. EPA#735-R-98-003. Online: <http://npic.orst.edu/rmppp.htm>

Rosenstock L, Cullen M. *Textbook of Clinical Occupational and Environmental Medicine*. Philadelphia, PA: W.B. Saunders Company; 1994.

Thompson DF, Thompson GD, Greenwood RB, Trammel HL. Therapeutic dosing of pralidoxime chloride. *Drug Intelligence and Clinical Pharmacy* 1987;21:590-3.

Tucker SB, Flannigan SA, Ross CE. Inhibitions of cutaneous paresthesia resulting from synthetic pyrethroid exposure. *Int J Dermatol* 1984;10:686-9.

III-3. Referrals: Understand when to make referrals to appropriate occupational / environmental health specialists.

Content

- The student should be able to make appropriate judgments of when, where, why, and to whom the patient should be referred. Treatment of pesticide exposure may be beyond the scope of practice for the provider. Consultation and referral to a specialist in the field of environmental and occupational health can facilitate timely diagnosis and optimal treatment. For more severe health events that involve numerous individuals, additional assistance can be obtained from the state health department or a state regulatory agency.
- Know how to contact (via national, regional, state, and local professional organizations and websites), and be able to compare and contrast the role, scope of practice, and setting of, the following environmental/occupational health specialists:
 - ▶ cooperative extension
 - ▶ environmental health specialist
 - ▶ industrial hygienist
 - ▶ occupational health nurse
 - ▶ occupational health nurse practitioner
 - ▶ occupational medicine physician

III-4. Follow-up: Know how to arrange appropriate patient follow-up.

Content

- Understand appropriate follow-up of patients who have had pesticide poisoning.
- Know that patients with organophosphate poisoning may need later neurologic follow-up.

Points of Insertion for III-3 and III-4

- Nursing
 - ▶ Leadership in nursing
 - ▶ Clinical nursing rotations such as Adult Health, Pediatrics, Maternal-Child Health Nursing
 - ▶ Community Health or Public Health Nursing courses (didactic and clinical)
 - ▶ Environmental Health Nursing or Emergency Nursing elective
- Medicine
 - ▶ 3rd year clerkships in Family Medicine, Pediatrics, or Internal Medicine
 - ▶ 4th year elective in Environmental Medicine or Emergency Medicine

■ Residency

▶ Primary care

Resources for Competencies III-3 and III-4

Hitchcock J, Schubert P, Thomas S. *Community Health Nursing*. Albany: Delmar Publishers; 1999; 15-16.

Institute of Medicine. *Role of the Primary Care Physician in Occupational and Environmental Medicine*. IOM Report, Division of Health Promotion and Disease Prevention, Washington, DC: National Academy Press; 1988.

Pope AM, Snyder M, Mood L, for Committee on Enhancing Environmental Health Content in Practice, Institute of Medicine. *Nursing, Health, and the Environment: Strengthening the Relationship to Improve the Public's Health*, Chapter 3. Washington, DC: National Academy Press; 1995; 17-8.

Rogers B. *Occupational Health Nursing Concepts and Practice*. Chapter 4. Philadelphia, PA: W.B. Saunders Company; 1994.

Rosenstock L, Cullen M. *Textbook of Clinical Occupational and Environmental Medicine*, Chapters 1, 10. Philadelphia, PA: W.B. Saunders Company; 1994.